Statistics 300 **Name:** _____ **Spring 2010**
Instructor: Lawrence C. Larsen **Sat. 9:00 a.m. - 1:05 p.m.**

Exam #3 – Final

(8 points; 8 minutes)

1. **Use the sample data in the box below to make an 88% confidence interval for the difference between the proportion of four-year graduates in the "< 30" group and the proportion of four-year graduates in the "30 +" group. Then answer the additional question below.**

   Based on your confidence interval, is it reasonable to claim that the proportion of four-year grads among all prisoners first convicted at age 30+ is the same as the proportion among all prisoners first convicted when younger than 30 years old?

   Yes **No** **Why?** _____

Completed four-year degree	Age when first Convicted	
	< 30	30 +
Yes	62	40
No	400	198
Total	462	238

(8 points; 9 minutes)

2. Use the data below to test the claim that "the longer you stay in school the more you earn." In other words, as years in school increase annual earnings also increase. The data are from a random sample of people 60 years old. (Use alpha = 0.05 for this test.)

Person	Years in School	Annual * Average Earnings
1	14	76
2	3	50
3	11	46
4	20	76
5	5	34
6	5	46
7	19	78
8	13	96
9	9	38
10	4	54

* In 1000's of dollars

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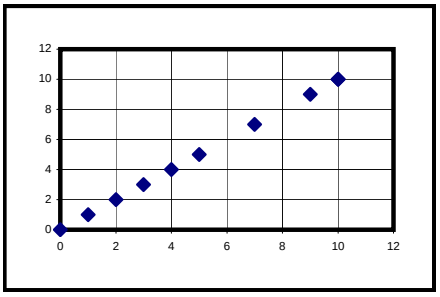
(9 points; 6 minutes)

3. Assign the letters of the appropriate figures to each of the "sample correlation" values offered below. If a correlation value has no appropriate figure to associate with it, write "none" next to that correlation value.

value of "r"	Figure Letter(s)
1.50	
1.00	
0.90	
0.70	
0.50	
0.00	
- 0.50	
- 0.70	
- 0.90	
- 1.00	

A



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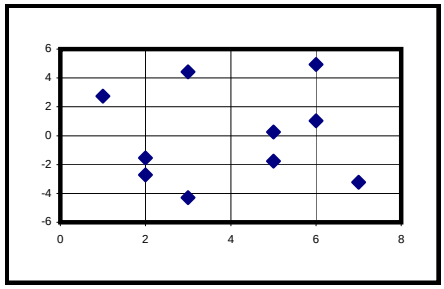

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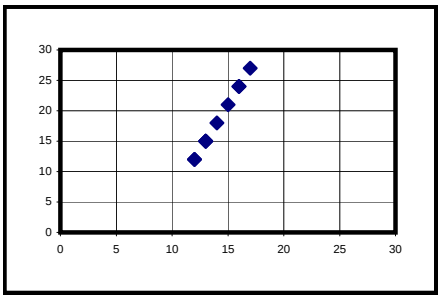

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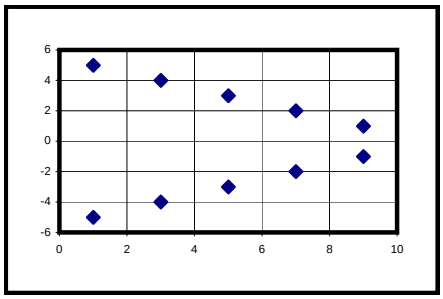

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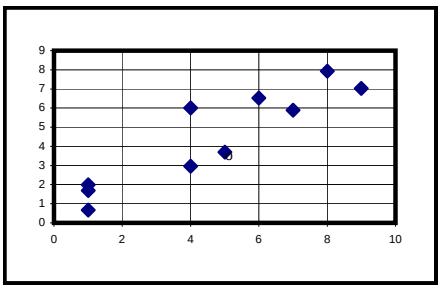

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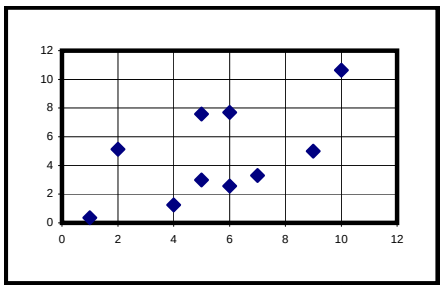

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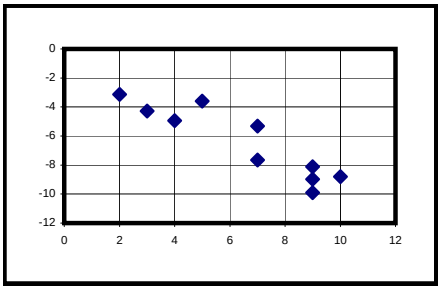
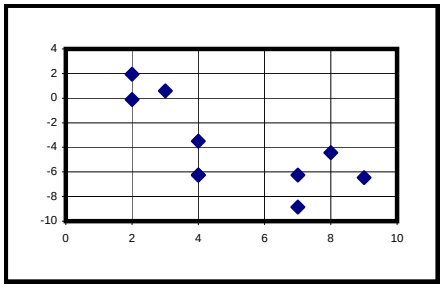
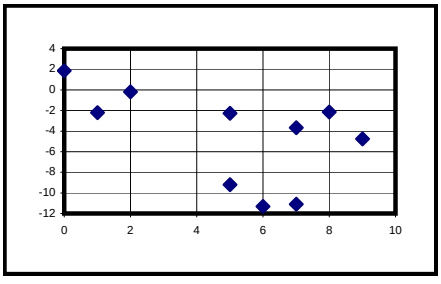


H



I



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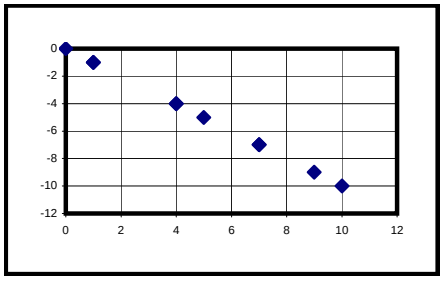

(8 points; 10 minutes)

4. Use the data shown in the table to test the claim that "size of vehicle" and "durability" (miles before a major repair is needed) are independent of each other. (Use a 5% significance level for the test.) **Look for ways to be efficient and quick in this problem.**

Vehicle	**Durability** (miles x1000 before 1st major repair)					**Row**
Size class	**10**	**20**	**30**	**40**	**>40**	**Total**
sub-compact	**22**	**33**	**43**	**55**	**47**	**200**
compact	**5**	**20**	**28**	**61**	**86**	**200**
mid-size	**8**	**12**	**33**	**53**	**94**	**200**
full-size	**11**	**18**	**29**	**42**	**100**	**200**
SUV	**5**	**13**	**26**	**60**	**96**	**200**
Column Total	**51**	**96**	**159**	**271**	**423**	**1000**

H_0: _____

_____

_____

H_1: _____

_____

_____

(8 points; 8 minutes)

5. **You make wood products with glue to join pieces together. The manufacturer of a new glue formula claims that wood joints using the new glue can hold on average more than 10 pounds more than joints that use the old formula. You make 16 joints using the new glue and 10 joints using the old formula. Then, you measure the weight each joint can hold. Use the results below to test the glue manufacturer's claim.** (Use $\alpha = 0.05$ for the test and assume the distributions of results for the two glues are bell-shaped but with different standard deviations.)

	Weight Held	
	New Glue	Old Glue
$\bar{x}$ =	201.1	177.6
s =	10.5	3.7
n =	16	10

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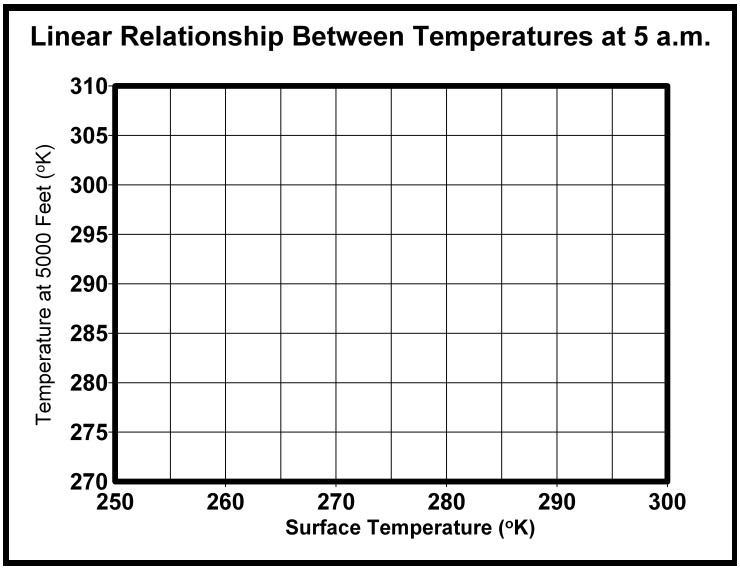
(14 points; 15 minutes)

6. Based on the data given below, do parts (a) through (m).

Observation	Temperature (°K) at 5000 feet	Surface
1	270	261
2	280	268
3	293	274
4	305	299
5	303	293
6	280	253



(a) Plot the data points on the graph.

(b) Enter data in calculator and write the equation for the best-fitting line: _____

(c) Plot the line on the graph.

(d) Predict the temperature at 5000 feet when the surface temperature is 273 °K?.

Predicted temperature = _____

(e) What is the proportion of the total variation in Y (temperature at 5000 feet) **that is "explained" by X** (temperature at the surface)**?** _____

(f) The expression for the total variation in Y is: _____

(g) The value of the total variation in Y is: _____

(h) The expression for the explained variation in Y is: _____

(i) The value of the explained variation in Y is: _____

(j) The expression for the unexplained variation in Y is: _____

(k) The value of the unexplained variation in Y is: _____

(l) The expression for the Standard Error of Estimate is: _____

(m) The value of the Standard Error of Estimate is: _____

(8 points : 8 minutes)

7(a) A company makes complicated laboratory equipment for analyzing chemical samples. To learn about the performance of their machines, the company works with 9 laboratories and gives to each four (4) identical samples of material to analyze.

A portion of the variability in the test outcomes represents differences between laboratories (which are considered as "treatments") and a portion represents differences from test to test within the same laboratory ("error"). Complete the Analysis of Variance table below and carry out the appropriate hypothesis test to decide whether the expected (mean) results are the same for all 9 laboratories.
(Use a significance level of 10% for this test.)

Analysis of Variance Table

Source	Sum of Squares	Degrees of Freedom	Mean Square	F	p-value
Laboratories			**41.13**		**0.08**
Error			**20.37**		
Total					

H_0: _____

_____

H_1: _____

_____

(1 point : 2 minutes)

7(b) If you took the variances of the measurements at each of the nine laboratories and "pooled" them, what would be the value of the pooled variance?

S^2_p = _____

(8 points; 8 minutes)

8. A company makes a sleep aid medication. They are interested in making a liquid version of their popular tablets, but some patients say liquid formulas usually taste bad. Use the following data to test the claim that the proportion of people that think two alternative liquid formulas taste bad is the same. (For this test, set the probability of a Type I error to 0.04.)

	Taste Test Result		
	Good	**Bad**	**Total**
Formula A	**378**	**22**	**400**
Formula B	**356**	**44**	**400**

H_0: _____

H_1: _____

(9 points; 10 minutes)

9. The form (tablet or liquid) of a sleeping aid medication may affect the speed at which the medication works. Use the results of the experiment below to construct a 90% confidence interval for the mean difference in the amount of time (elapsed time) before patients fall asleep using the tablet compared to using the liquid. Assume that the variation in times is the same for both tablets and liquid. Five patients used the tablets and another four patients used the liquid.

Elapsed Time Before Sleep		
Patient	**Tablet**	**Liquid**
1	**26**	**21**
2	**23**	**18**
3	**19**	**24**
4	**23**	**16**
5	**24**	

(8 points; 9 minutes)

10. A major news organization is interested in the public issues that registered voters think are most important. A stratified random sample of 340 registered voters is selected to represent the whole population of voters. Each voter is asked to select from a list of 6 issues the one that is most important. Compare the results to see if they are significantly different from the proportions expected by the news organization that carried out the study. (Let α be 0.05 for the test.)

H_0: _____ **H_1:** _____

_____ _____

	Proportions	
Issue	**Expected**	**In Sample**
Traffic Congestion	**10%**	**15%**
Pollution	**20%**	**15%**
Taxes	**15%**	**23%**
Deficits	**10%**	**22%**
Education	**25%**	**19%**
Health Care	**20%**	**6%**
Total	**100%**	**100%**

(8 points; 9 minutes)

11. The form (tablet or liquid) of a sleeping aid medication may affect the speed at which the medication works. Use the results of the experiment below to construct a 90% confidence interval for the mean difference in the amount of time (elapsed time) before patients fall asleep using the tablet compared to using the liquid. Six patients used the tablets for three months and then used the liquid. The order of tablet and liquid use was randomized.

Elapsed Time Before Sleep		
Patient	**Tablet**	**Liquid**
1	**26**	**21**
2	**23**	**18**
3	**19**	**24**
4	**23**	**16**
5	**24**	**20**
6	**24**	**19**